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Exploring Incel Language and Subreddit Activity on Reddit

UVM CEMS Honors Thesis

Kelly Gothard, Peter S. Dodds, Christopher M. Danforth

Abstract

Incels, or involuntary celibates, are individuals who struggle socially, due to their inability to have a romantic or sexual relationships. In popular culture, the community is known for churning out memes, strange made-up words, and startling acts of violence. Behind the veil of humor and "relatable content" lies an anti-feminist ideology that channels Incel loneliness into intense resentment towards themselves, women, and society at large. At its most extreme, Inceldom has motivated attacks like the 2014 Isla Vista attack and the 2018 Toronto van attack, resulting in the deaths of six and ten, respectively. To investigate the overall activity of this community, we look at the timeseries of comment activity on three popular Incel forums on Reddit. We then compare the words commented from one of these forums, r/Braincels, to a random Reddit comment corpus using rank divergence. The timeseries of the words that appear more often in r/Braincels indicates that these words may be a fingerprint for Incel communities.

Contents

1	Introduction	3
2	Data	7
3	Methods	9
4	Results	12
5	Conclusion	25
6	Acknowledgements	26

1 Introduction

"Incels", a portmanteau of "involuntary celibates" are individuals who identify with online communities that claim to offer support for people who are unable to make romantic and intimate connections. The term "Incel" was coined in 1993 by a Canadian university student who started a website for people who experience romantic and social barriers due to social awkwardness. When she gave the site away in 2000, the community had already inadvertently become a space for men to express and validate their anger towards all women for withholding affection and intimacy. Today, Incel communities are known for their violent misogynistic views, their belief in caricatured social hierarchies, and the unique language they have developed [1]. Figure 1 shows two popular memes that have circulated on the internet, which outline two categories of man and two categories of woman.

Inceldom is part of a larger ideological ecosystem, called the "Manosphere". The Manosphere has been criticized for justifying anti-feminist networked online abuse as activism and productive discourse [2] [3]. In addition to Incels, the Manosphere is comprised of Men's Rights Activists, Men Going Their Own Way (MGTOW), and Pick-Up Artists. Each of these groups have a different approach to responding to their dissatisfaction with the current state of societal gender and sex expectations, but subscribe to the same underlying philosophy, called the "red pill" [2]. When an individual has "taken the red pill", they have enlightened themselves to a reality in which women wield feminism as a weapon against men, depriving them of sex and love. Pick-Up Artists seek to regain power by sexually taking advantage of women, MGTOW members voluntarily reject relationships with women altogether, and Incels paradoxically yearn for affection from women and despise them for withholding it.

A unique lexicon emerges Incels beliefs are encoded into a unique lexicon that emerges from the community. Words such as 'Chad', 'Stacy', 'Becky', 'normie', and 'beta' are used to label individuals as the intersection of their gender and their perceived social standing.



Figure 1: Popular Incel Memes (left to right): Virgin, Chad, Becky and Stacy. The 'Virgin' represents the Incel, and is depicted with his head down, a thin stature and pale skin. He is meant to be inferior to the 'Chad', who is muscular but brutish and unintelligent. 'Becky' is meant to be a second-class woman, who reads books, does not care about her appearance and is a feminist. Lastly, 'Stacy' is the female instance of Chad. She augments her appearance through fake tan and cosmetics, she is promiscuous and shallow.

Additionally, variations of the term 'incel', such as 'mentalcel', 'wristcel', and 'blackcel' specify the type of incel an individual might be. A 'mentalcel' identifies as an Incel because of mental illness and a 'blackcel' identifies as an Incel because they are black. We care about this unique encoding because when many of these words are used together, it is an indication of Incel community activity.

A number of Incels have gained notoriety for taking their frustrations out on the world around them. Psychologists have speculated that individuals who have experienced bullying or emotional distance from family members are most susceptible to becoming Incels, as their internal hatred can quickly turn outwards to society [4]. These communities gained media attention when, on April 23rd 2018, Alek Minassian posted a rallying cry for Incels on social media and subsequently drove a van into a crowded Toronto sidewalk, killing 10 and injuring 16. His post contained a number of key Incel words, as well as reference to one of the first Incel-associated mass murderers:

"Private (Recruit) Minassian Infantry 00010, wishing to speak to Sgt 4chan please. C23249161. The Incel Rebellion has already begun! We will overthrow all the Chads and Stacys! All hail the Supreme Gentleman Elliot Rodger!" [5]

Alek Minassian is just one of many mass murderers that the Incel community idolizes [6]. Minassian's post cited Incel icon Elliot Rodger, who orchestrated a similar attack in 2014.

Elliot Rodger killed six people and injured 14 others after sending a written manifesto to people he knew [7], accompanied by video uploaded to YouTube that details his loathing for women and anger towards society. Elliot Rodger became an icon for Incels, and they refer to him as 'ER' or 'the Supreme Gentleman'. Various other attacks have been associated with the Incel cause, gaining the attention of the media and the United States Airforce, which held a briefing to discuss the increasing national threat of Incel attacks.

In addition to physical threats, the growing population of young men that subscribe to Incel world-views directly combats the feminist movement and other movements towards gender equality. The existence of this community creates a space where violent and inhumane views on women and sex can exist and be socially acceptable. The popularity of the Incel community further justifies its pillars to its members, and by building a sense of solidarity, the Incel community views themselves as noble rebels against a common cause. It is critical to address the underlying systems that set individuals up for the possibility of becoming Incels, but it is also critical to dismantle these spaces in the first place.

Incel communities exist on a variety of platforms, but a sizeable community has existed on Reddit since approximately 2016. Reddit is a platform that hosts subreddits, which are forums that are created and moderated by users and they are largely topic specific. r/Incels is considered by the community to be the first Incel subreddit to exist on Reddit. Reddit banned r/Incels on November 7th, 2017 for inciting violence against women, as part of a larger effort to control violent content on the site [8]. Shortly thereafter, r/Braincels gained popularity. It is during this time that the Toronto van attack took place. In the following months, Reddit quarantined r/Braincels twice, for a short period on September 25, and from January 2019 through May 2019. The subreddit was banned on September 30th 2019, shortly after the US Army sent out a memo to service members regarding the growing threat of violence from Incels, triggered by FBI intelligence on Incel activity regarding *The Joker (2019)* [9]. After the banning of r/Braincels, various other subreddits showed early signs of

popularity, but many were banned after only a few weeks of existence [10].

There is a highly contested trade-off for banning a subreddit due to decidedly harmful speech: the limitation of free speech. Internet spaces like forums and blogs provide the medium for transnational individual activists to congeal and debate and disseminate the pillars of their cause, which has been empowering for groups that cannot gather publicly [11]. In the quote below, Bart Cammaerts, a lecturer in the Media and Communication Department of the London School of Economics and Political Science, lists the potential advancements that a geographically decentralized social movement has by gathering in online spaces.

”Here the internet is considered by many scholars as a potential means to extend the working of transnational social movements geographically, to organise internationally, to build global or regional coalitions with like-minded organisations, to mobilise beyond their own constituencies, to spread information on a global scale independently and thereby support the development of global or transnational public spheres (Scott Street, 2001; Dahlberg, 2001; Norris, 2002; Bennett, 2003; Kahn Kellner, 2004).” [12]

One could argue that by allowing Incel forums to exist, we as a society are facilitating the coalescence of individuals whose primary point of activism is to combat modern feminism and to degrade the position of women in society. However, in the 2015 bannings of r/fatpeoplehate and r/CoonTown, researchers found that the ban was effective in decreasing the number of accounts associated with the banned subreddits, and decreasing the use of words associated with hate speech from those banned subreddits in content from accounts that did remain on Reddit [13]. Another study of the same time period in 2015 found that there was a notable migration of Reddit users to other platforms [14]. The principle of banning a toxic community clashes with the practicality of actually reducing the content that is produced by the community. Incels have utilized a variety of platforms, like Reddit, 4chan, incels.me, incels.co, and many more that are likely undetected by the general population.

The decentralized, anonymous nature of Incels, in addition to blurring the lines between support group and hate group, makes it difficult to detect a toxic Incel forum and respond to it appropriately.

Due to their socially unacceptable views on women and intimacy, coupled with extreme emotional volatility and glorification of violence, Incel ideals pose a threat to themselves and to the rest of society. For these reasons, we explored Incel communities by examining their unique language patterns and their activity on other forums on Reddit. Insights into the Incel lexicon have the potential to inform future Incel-associated subreddit/content detection models based on language usage. Additionally, we can identify forums that may serve as a space for disseminating Incel-related content to the rest of Reddit via subreddits that Incels use. By learning more about Incel behavior on Reddit, we can begin to track their activities on other platforms and intercept the spread and normalization of misogyny and hatred online.

2 Data

Reddit comments data were collected from pushshift.io[15], an open-source curator of Reddit data. We chose to study comments instead of submissions because comments make up the majority of Reddit publishing activity. In the Reddit pushshift dataset, encompassing nearly all of Reddit since 2005, there are 652 million submissions and 5.6 billion comments [15]. A total of 2,929,388 comments from r/Braincels, authored by 56,739 unique authors were collected from the pushshift API, containing information on the author of each comment, the subreddit that the comment was published on, the text body of the comment, and the UTC timestamp at the time the comment was published. r/Braincels comments were retrieved from pushshift.io, as opposed to the Reddit API, because the data collected by pushshift.io is from monthly "snapshots" of all comments on Reddit, allowing us to access comments

from banned subreddits.

A control corpus of 1,686,101 randomly selected comments from Reddit was collected using the Reddit API via the Python Reddit API Wrapper (PRAW). This was done by randomly selecting a subreddit, randomly selecting a post, and randomly selecting a comment from that post thread. The random corpus was gathered using PRAW instead of the pushshift.io API because PRAW has features for randomly selecting subreddits, posts and comments, whereas the pushshift.io API does not.

Table 1 summarizes the comment and unique user count for comments from r/Incels, r/Braincels, r/ShortCels and from the random comments dataset.

Subreddit	Total Unique Users	Total Comments
r/Incels	36,310	1,975,037
r/Braincels	56,740	4,843,905
r/ShortCels	9,266	338,130
Random	712,998	1,686,101

Table 1: Summary of r/Incels, r/Braincels and r/ShortCels Usage. All available comments from r/Incels, r/Braincels and r/ShortCels were collected from the pushshift Reddit dataset. These subreddits were chosen because of their cultural significance to the Incel community, as stated on other Incel forums and wikis. The random set of comments was retrieved from the Reddit API using PRAW.

Additionally, 5,000 usernames were randomly selected from the random comment corpus, and 5,000 usernames were randomly selected from the r/Braincels comment corpus. We then used the pushshift API to gather the entire comment history for each these usernames, which included the text body, the subreddit it was published on, and the UTC timestamp at which the comment was published. To compare the distribution of comments per author, subreddits per author and authors per subreddit for the random set of authors to the r/Braincels set of authors, we plotted each log-log Zipf distribution in Figure 2.

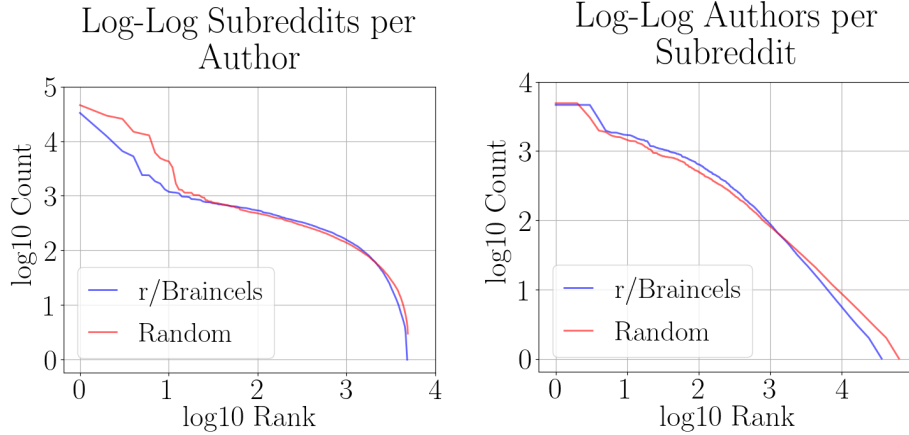


Figure 2: Log-Log Zipf Distributions of Collected Comment Histories: Subreddits per Author and Authors per Subreddit. These distributions were computed from a sets of 5,000 authors from the r/Braincels comment corpus and the random comment corpus. We collected the comment history for each of these 10,000 users and show the Zipf distribution of the unique number of subreddits that each of these authors commented on and the number of unique authors from our sets of 5,000 that commented on each subreddit that appeared in the comment histories.

Each of the distributions appear to have similar shape, which allows us to compare them. If the distribution of comments per author in one system was different than the other, it might mean that there are more high-frequency authors, who’s behavior may differ as a result of their position as a high-frequency author. Similarly, we would like our distributions of subreddits per author and authors per subreddit to be similar between the r/Braincels system and the random system because the behavior of authors who post on many subreddits may vary differently from those who post on fewer subreddits.

3 Methods

Activity on our selected Incel subreddits is summarized by the timeseries of comments per day and unique authors of comments per day. Additionally, we investigated the timeseries of comments per day, given that they were the first comment published by an author. To count first comments by an author per day, we selected the comment with the earliest UTC

timestamp per author, and then aggregated by day to get the count of first comments by an author per day. This measure is used as a proxy for when an account "joined" any of these communities, under the assumption that all accounts comment at least once and that they comment shortly after joining the community. These timeseries inform our understanding of activity patterns on our selected Incel subreddits.

The extent of author movement from subreddit to subreddit might tell us how resilient the community is to bans. The number of authors that made comments in both r/Incels and r/Braincels, and in both r/Braincels and r/ShortCels was computed to observe the migration of authors from subreddit to subreddit. Many author usernames were deleted and it is possible that some were banned in conjunction with each Incel subreddit ban, therefore this crude measure of migration may not represent the true migration from one subreddit to the next.

We used rank-turbulence divergence as an instrument to compare the distributions of words in r/Braincels comments vs random comments. Rank-turbulence divergence is a method for comparing two Zipfian distributions [16] by illuminating types, or the entities being compared, that have high rank-turbulence divergence and high divergence contribution. We compared the distribution of one-grams that appeared in our corpus of 4,843,905 comments from r/Braincels to the distribution of one-grams that appeared in a random corpus of 1,686,101 comments from Reddit by computing the rank divergence contribution for each word. Rank divergence is the absolute difference in the inverse rank of a word between two corpora, which is then dampened by the tunable alpha parameter to devalue high frequency words as alpha approaches zero. We chose rank divergence as a measure of a words imbalance between two corpora because it normalizes word frequencies by converting to rank and reduces the presence of high frequency words that may not be meaningful and clutter the most key words. Additionally, the rank-rank histogram and shift plot shown in Figure 7 provides a way of visualizing the most key words in both corpora while maintaining

quantitative dimensions like rank, density of words, and rank divergence contribution.

The distribution of subreddits by the number of comments from r/Braincels authors versus random authors was compared with rank divergence to identify key subreddits that r/Braincels authors comment on more than random authors. The comment history of 5,000 randomly-selected authors from our r/Braincels and corpus and from our random comments corpus was collected from the pushshift Reddit dataset. We filtered the 5,000 random author and r/Braincels author timelines to contain authors who had commented on more than one subreddit, and to include subreddits that have had more than one author comment on them, leaving 4,631 r/Braincels authors and 4,895 random authors.

Previous data-driven studies on Incel-related communities have aimed to identify key words, to make inferences about Incel demographics, to characterize activity on various platforms, and to automate detection of related communities [17, 18, 19, 20]. A study by Jaki et al used statistical tests on word counts to identify key words in Incel corpora, and visualized their results as a word cloud [17]. Our approach differs from the approach used by Jaki et al, where we use rank divergence, couple with a rank rank histogram and word shift plot to visualize key words from Incel comments. Farrel et al create various lexicons to categorize themes on Incel forums, but we do not utilize this method as it may introduce bias from the researchers, as well as bias towards particular topics due to imbalance in the size of each lexicon [18]. Ribeiro et al study account creation, post and author timeseries, Google toxicity score, and user migration in various Manosphere communities [19]. Papadamou et al focused on Youtube content posted in Incel subreddits, sentiment scoring of Youtube comments, and measuring the accessibility of Incel content on YouTube [20].

We contribute to research in online misogynist communities by using rank divergence as a measure for comparing the language and subreddit activity distributions of these communities to a random comments set. This method reduces the bias that is introduced with comparing the counts of words, as well as the bias introduced by statistical testing when

data is large. Additionally, we avoid limitations brought on by predefined lexicons by identifying words that are important to Incel communication based on their existing presence and rank as opposed to seeking them out. Lastly, rank divergence is interpretable and can be visualized such that the rank of the word in each corpus, as well as its rank divergence contribution, can be interpreted in the context of other words in the corpora.

4 Results

The word "incel" has increased in prevalence on Reddit. Figure 3 shows the timeseries of the ratio of comments containing "incel" to total comments on Reddit. This timeseries begins in December 2005, six months after the creation of Reddit. Through the first ten years of Reddit, very few comments contain "incel". The majority of comments that contain "incel" were published between September 2016 to April 2020. There are various days that show a marked peak in comments containing "incel". The first peak, November 7th 2017, occurred five days after r/Incels was banned. The peak on April 23rd 2018, corresponds with the date of the Toronto van attack. Lastly, the peak on July 14th 2019 occurred on the release date of BBC's *Inside the Secret World of Incels*.

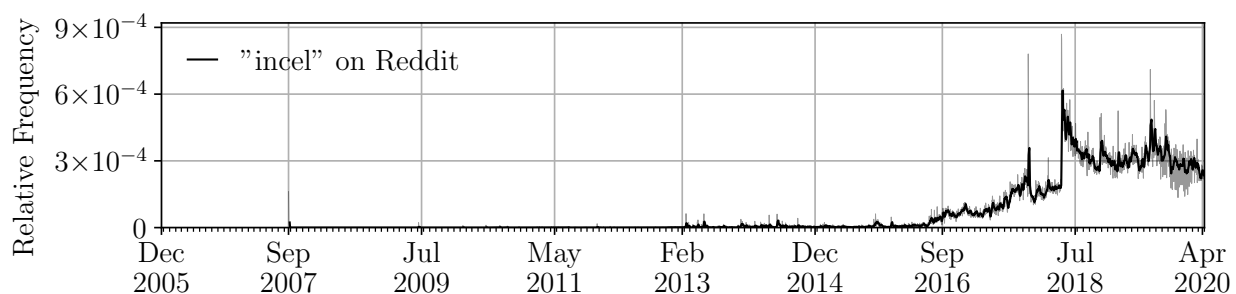


Figure 3: Relative Frequency of "incel" on Reddit. The ratio of daily comments containing "incel" to total daily comments on Reddit is shown, as well as a 14 day rolling average. The first peak, November 7th 2017, occurred five days after r/Incels was banned. The second peak, on April 23rd 2018, corresponds with the date of the Toronto van attack.

To investigate engagement history in Incel communities, we use the total comments per day and total unique authors per day on r/Incels, r/Braincels and r/ShortCels as a measure of daily subreddit activity. The timeseries in Figures 4 and 5 show the daily comment count and the total unique authors per subreddit, respectively. The banning dates of r/Incels and r/Braincels are labeled. We interpret these timeseries by identifying extrema in activity during relevant periods of time, as well as qualitatively remarking upon the shape of the timeseries. These *prima facie* interpretations are preliminary and for the purpose of informing further study into activity on these subreddits. Quantitative justification for identifying patterns in the timeseries are necessary to confirm our qualitative observations.

Breaks in the timeseries are on days where there were no comments published on each subreddit. These days include "quarantines" which is a method that Reddit uses to enforce community standards on subreddits. According to Reddit, "Quarantined communities will display a warning that requires users to explicitly opt-in to viewing the content. They generate no revenue, do not appear in non-subscription-based feeds (eg Popular), and are not included in search or recommendations" [21]. The pushshift.io dataset does not contain comment data for these subreddits during quarantines, so those time periods will appear as having no comments published. There is no official record of quarantines on Reddit, so we cannot make judgements about which days had zero comments because of a quarantine and which days did not.

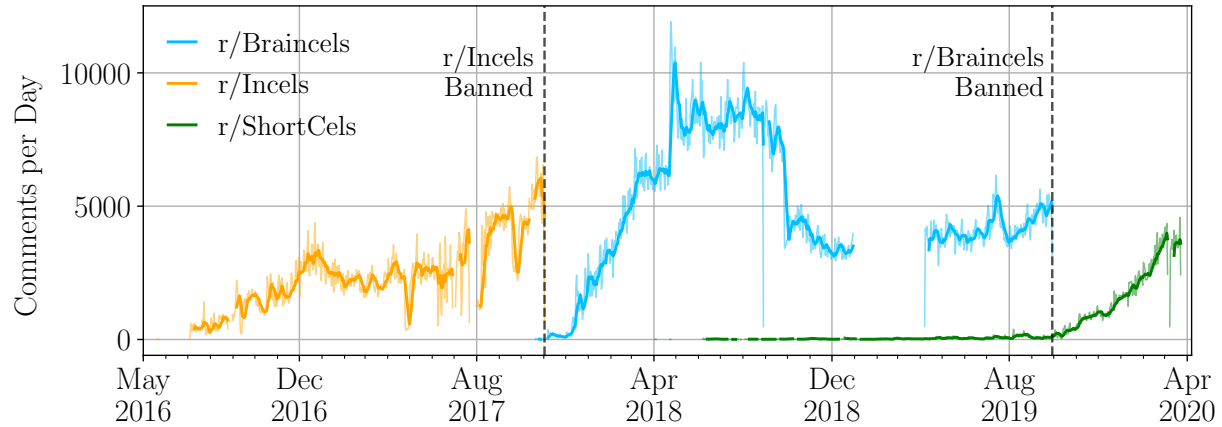


Figure 4: Total Comments per Day on r/Incels, r/Braincels and r/ShortCels. The timeseries above shows the count of comments per day on r/Incels, r/Braincels and r/ShortCels, as well as the 14 day rolling average. Each of these subreddits are considered to be central to Incel activity on Reddit. This timeseries suggests that when an Incel-associated subreddit is banned, another one arises to take its place. Additionally, the peak of comment activity in this timeseries is on the day of the Toronto van attack, a mass murder in the name of Inceldom.

In addition to total daily comments, total unique comment authors per day summarizes daily activity on our selected subreddits. We counted the number of unique users publishing comments per day, shown in Figure 5, and find that this timeseries exhibits similar behavior to the timeseries of total comments per day. Both timeseries indicating that the increases and decreases in the volume of comments is not necessarily attributable to the same set of users posting more on a particular day, but is also contributed to by an actual increase in user traffic on those subreddits.

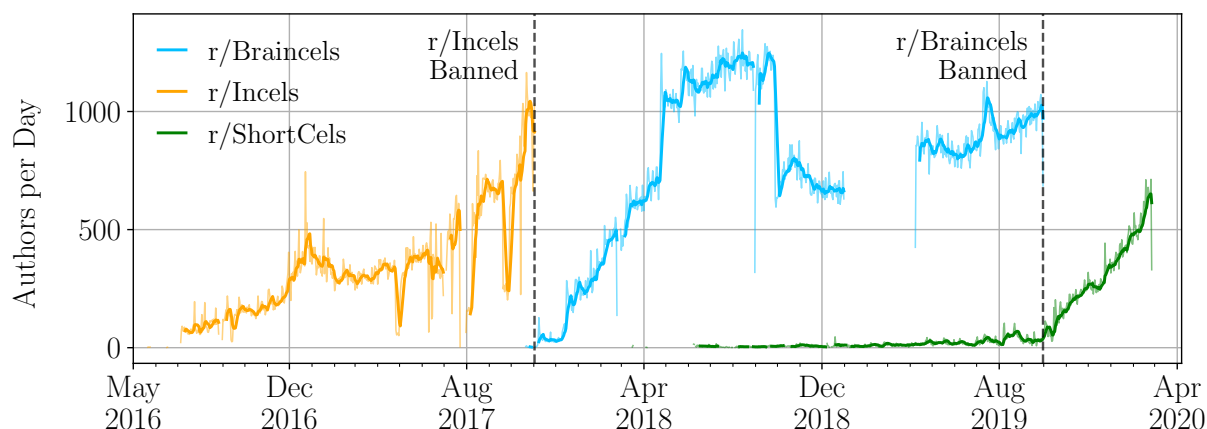


Figure 5: Number of Unique Authors per Day on r/Incels, r/Braincels and r/ShortCels. The number of unique comment authors per day, and the 14 day rolling average, for each subreddit is shown in the timeseries above. The timeseries of unique authors per day is qualitatively similar to the timeseries of total comments published per day, therefore the increased comment activity may be associated with increased author activity.

The timeseries for total comments and unique authors per day indicate that when an Incel-populated subreddit is banned, it is quickly replaced by another one. This might suggest that users from the banned subreddit migrate to the new replacement subreddit, and that we should be able to see this migration through usernames appearing in comments from more than one of the above subreddits. We counted the usernames that had published comments in both r/Incels and r/Braincels, and in both r/Braincels and r/ShortCels. 4,757 authors, or 13%, that appeared in r/Incels also appeared in r/Braincels, and 2,728 or 5%, of r/Braincels authors appeared in r/ShortCels. To further investigate when authors started commenting on any of these three subreddits, we plotted the timeseries of each authors' first comment in Figure 6.

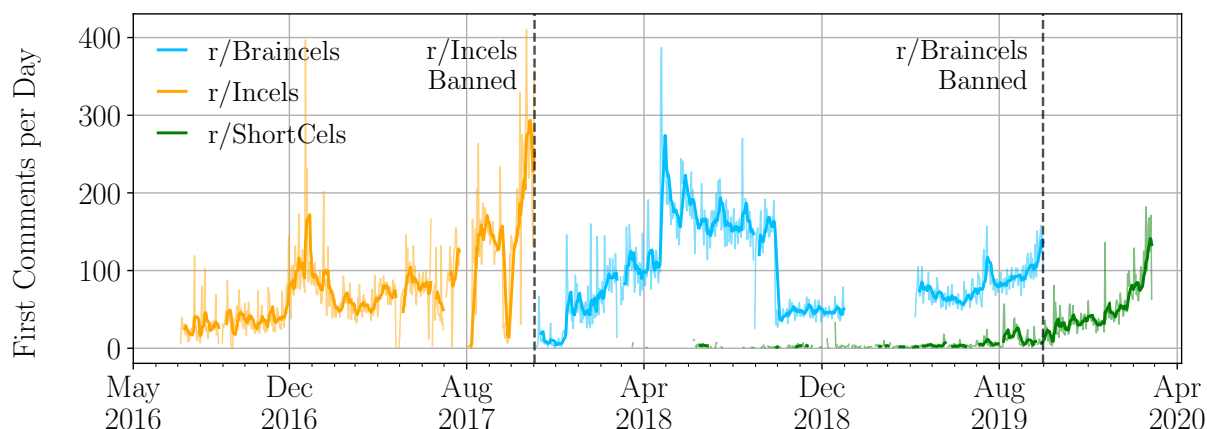


Figure 6: Number of Authors’ First Comments per Day on r/Incels, r/Braincels and r/ShortCels. The timeseries of comments where only the first comment by each author is counted is an indication of when authors first became engaged in any of these three subreddits. This timeseries exhibits a similar pattern to the timeseries of unique authors and of total comments per day.

The lexicon that Incels use to communicate is unique to the Incel community, and its usage can be confirmed by comparing word rankings. To compare the distribution of word frequency from comments on r/Braincels and our corpus of randomly selected comment, we utilized the rank-turbulence divergence instrument. By creating a histogram of the rank of a word in the random corpus and the rank of a word in another corpus, we can observe the density of changes in the rank of a word between these two systems. By computing the rank divergence, we emphasize those words that exhibited a marked change in rank. The rank-turbulence divergence instrument also incorporates a word shift plot that shows words and their respective ranks in each system, in decreasing order by their rank divergence contribution. Figure 7 is a rank-turbulence divergence plot of the distribution of words from our random comments corpus versus the distribution of words from our r/Braincels comments corpus.

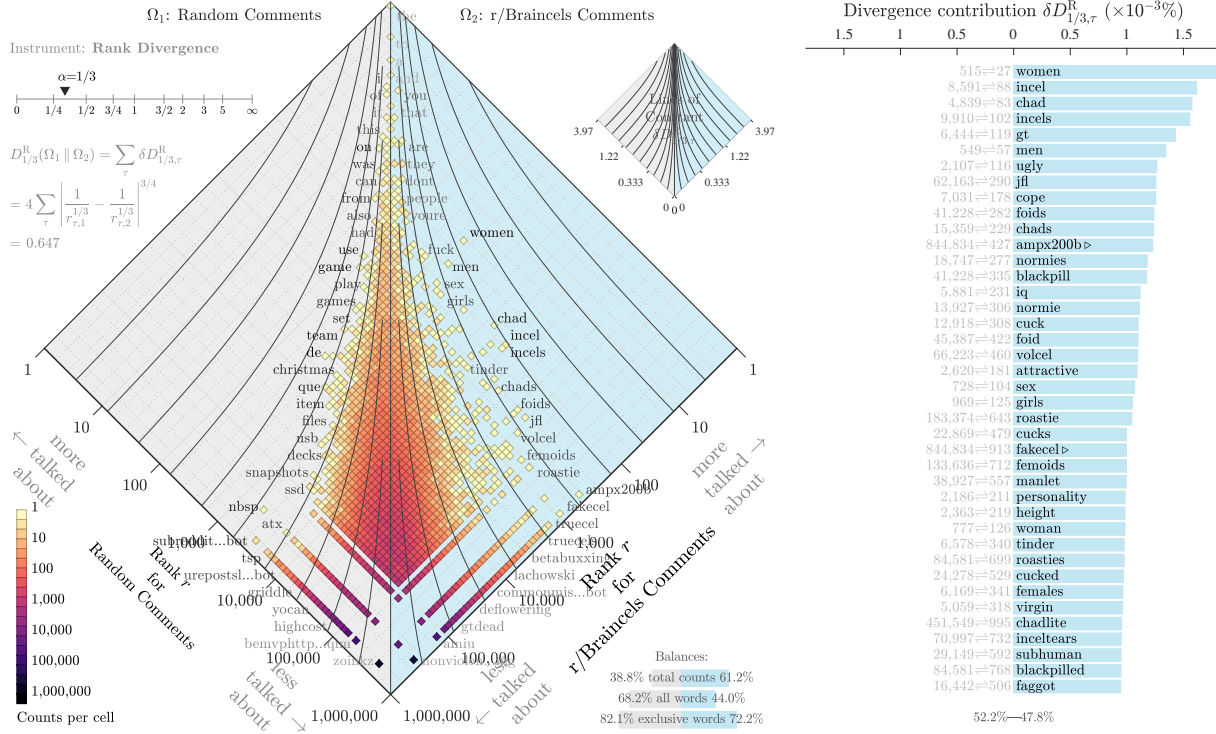


Figure 7: Rank-Turbulence Divergence of r/Braincels Word Rank Distribution vs Random Word Rank Distribution. The rank-rank histogram on the left shows the density of words by their rank in the r/Braincels comments corpus against their rank in the random comments corpus. Words at the top of the diamond are higher frequency, or lower rank. For example, the word "the" appears at the highest observed frequency, and thus has the lowest rank, rank 1. This word has the lowest rank in both corpora, so its coordinates lie along the center vertical line in the plot. Words such as "women" diverge from the center line because their rank in the r/Braincels corpus is higher than in the random corpus. Nearly all of the high-divergence words in the shift plot on the right of the figure pertain to gender, sex and the Incel lexicon.

We selected words with high divergence contribution from Figure 7, and plotted the log timeseries of each word, shown in Figure 8. The timeseries of these words gives us an indication as to why each word might be so highly ranked in the r/Braincels corpus. For example, a word may have had a short period of high frequency that contributed greatly to its rank, but may not be as useful to understanding the Incel lexicon as words that appear consistently over time. The log timeseries of the words below show that the relative frequency of the words "women", "men", "incel", "chad", "cope", "cuck", "normies", "virgin", and

”blackpill” is consistent over time.

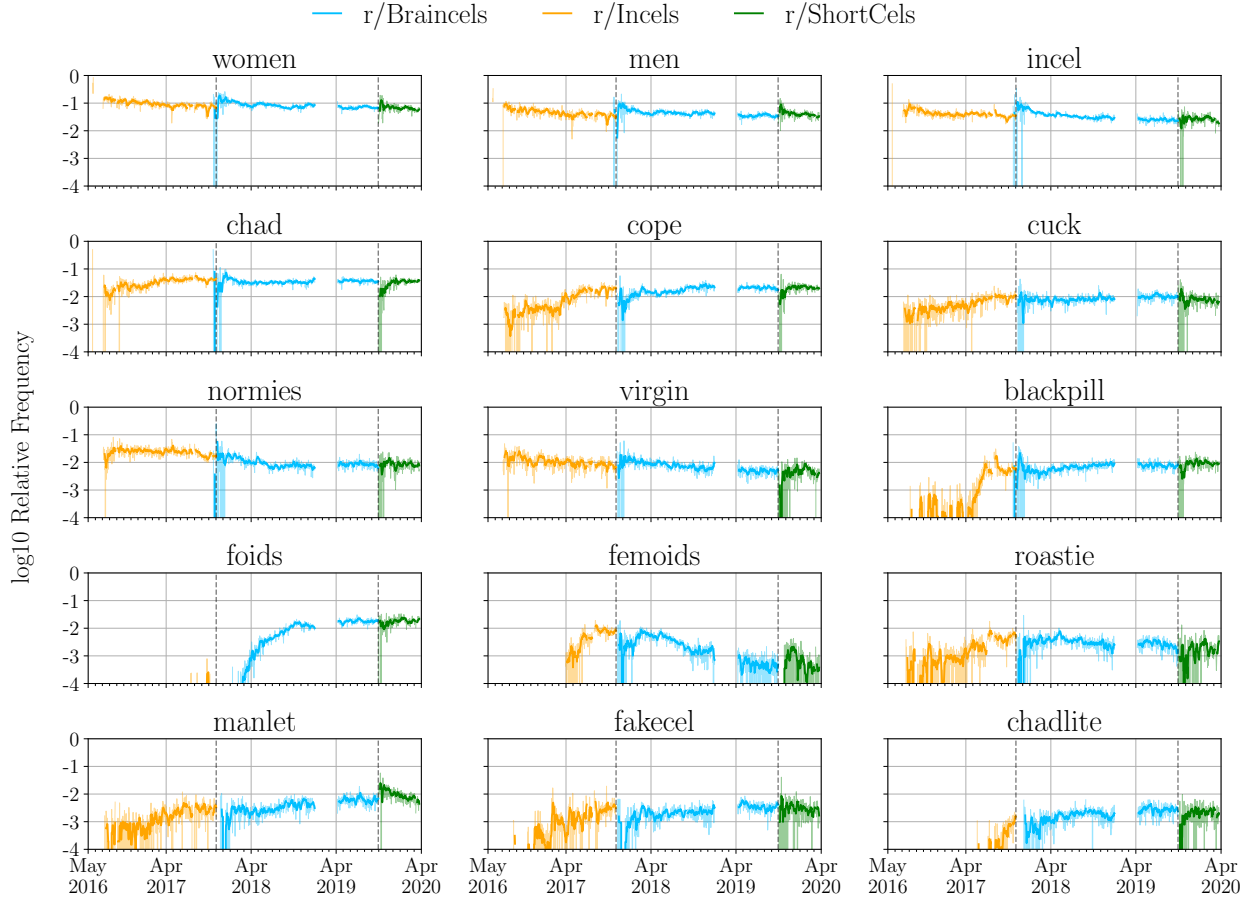


Figure 8: Timeseries of Log Relative Frequency of High Divergence-Contributing Words on r/Incels, r/Braincels, and r/ShortCels. Each timeseries shows the ratio of total comments on a subreddit that contain a given word to total comments on that subreddit. Here, we look at the timeseries of words that had high divergence contribution in Figure 7 on r/Incels, r/Braincels, and r/Shortcels. In addition to the daily relative frequency values, a 14 day rolling average is shown.

We gathered the comment history of 5,000 random authors and 5,000 r/Braincels authors to count how many comments each author had published to any subreddit. We kept those authors that had commented on more than one subreddit, and kept those subreddits that had more than one author comment on them. To identify subreddits that r/Braincels users comment on more than random users, we ranked the subreddits that random and r/Braincels

users commented on by the total number of comments on that subreddit. The histogram on the left of Figure 9 shows the rank of each subreddit in the random corpus versus the rank of each subreddit in the r/Braincels corpus. The colored cells indicate the density of subreddits at those rank coordinates. The subreddits with the highest rank divergence are shown in the shift plot on the right. The subreddits on the right of the shift plot are subreddits that have a high rank divergence towards the r/Braincels users, meaning that r/Braincels users participate in those subreddits more than random users. We find that some of these subreddits are other Incel-associated subreddits: r/IncelsWithoutHate, r/PurplePillDebate, r/ForeverAlone, r/shortcels.

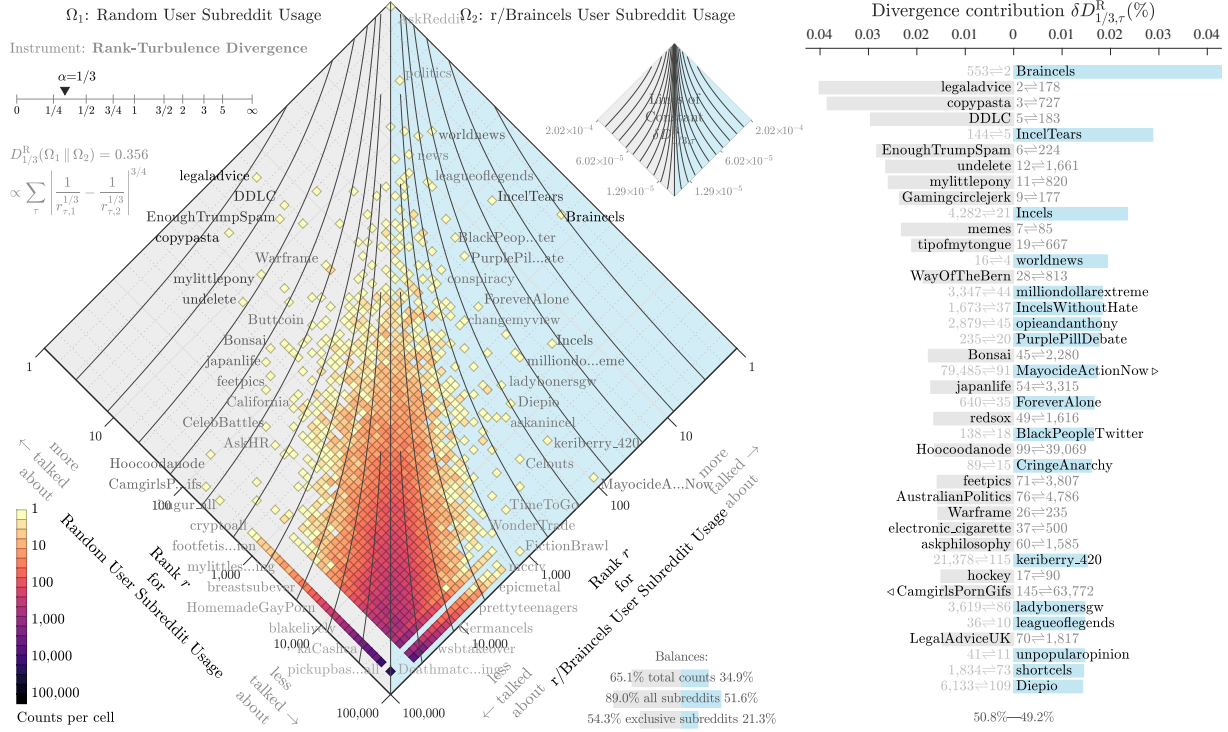


Figure 9: Rank-Turbulence Divergence of r/Braincells Authors Subreddit Ranks vs Random Author Subreddit Ranks. We gathered the comment history of 4,631 r/Braincells authors and 4,895 random authors, counted the comments per subreddit that any of these users had commented on, and ranked each subreddit by its comment count. The left side of the rank-rank histogram shows the subreddits that were commented on more by our set of random authors and the right side shows subreddits that were commented on more by r/Braincells authors. We computed the rank divergence for each subreddit given its rank among the random authors and among r/Braincells authors. The shift plot shows the top 40 subreddits by divergence contribution, as well as the direction they contribute to.

To summarize our results, we find that the timeseries of total comments, unique authors, and first comments look similar, in that each of the three subreddits appears to have its own regime of popularity that is replaced by another when a subreddit is banned. In the content of r/Braincells comments, words like "women", "chad", "incels", and "foids" have high divergence contribution when compared to a random corpus of Reddit comments. These familiar words align with our expectations: many of the high divergence contributing words come from the Incel lexicon and many of them are topically relevant to topics on gender, sex,

appearance. The timeseries of comments containing these words on r/Incels, r/Braincels, and r/ShortCels appear stable, which may indicate that these words are crucial to communication on these subreddits. Lastly, the other subreddits that r/Braincels authors have published comments on are other Incel-related subreddits, as well as subreddits that are associated with offensive or alt-right humor.

Discussion

The change in total comments published per day on r/Incels, r/Braincels, and r/ShortCels shown in Figures 4, 5 and 6 suggests that there may be a relationship between these subreddit bans and increased activity in related subreddits following these bans. The growth in r/Braincels comments per day, following the ban of r/Incels, suggests that the ban may not have been effective in reducing the presence of the Incel community on Reddit. The banning of r/Incels was followed by the rise of commenting activity on r/Braincels, and the banning of r/Braincels was followed by the rise of commenting activity on r/ShortCels. Specifically, the maximum daily comments on r/Incels occurred on October 23rd 2017, shortly before the subreddit was banned, and just after r/Braincels was created on October 20th. After r/Incels was banned, r/Braincels surpassed the maximum daily comments for r/Incels on March 6th 2018, approximately five months after its creation. The last recorded daily comment count for r/Braincels was 3149 comments on September 29th, 2019. Prior to this day, r/Shortcels had achieved a maximum of 384 comments (August 7th, 2019). After the ban of r/Braincels, r/ShortCels surpassed the last recorded r/Braincels comment count on February 7th, 2020, five months after the ban of its predecessor. Due to the limited number of subreddits studied here, we cannot say that there is a larger pattern of subreddit bans and five months of subreddit recovery. However, this timeseries prompts further investigation into how many authors migrate from a banned subreddit to a new one, the amount of time the community

takes to "recover" from major subreddit bans, and how effective it is to ban Incel forums on Reddit.

Migration from subreddit to subreddit, at its most simplest, can be studied by measuring how many users appeared in two "consecutive" subreddits. By consecutive, we mean subreddits that showed increases in commenting activity after another was banned. We counted how many authors appeared in each subreddit migration path - r/Incels to r/Braincels and r/Braincels to r/Shortcels - and found that 13% of r/Incels authors migrated to r/Braincels and 5% of r/Braincels authors migrated to r/ShortCels. These percentages of author migration likely do not capture the actual percent of author migrations because many of these accounts are used as temporary, disposable accounts to produce content that is more radical than one might produce in their main account and to prevent an online identity from being associated with that account, adding another layer of anonymity. These are called "throwaway accounts", and although many of them contain variants of the words "throw" and "away", we do not know how many of the usernames in our set of r/Incels, r/Braincels and r/ShortCels comments are owned by the same individual. Further work on detecting throwaway accounts by the username text and by submission activity must be done to better understand user migration from subreddit to subreddit.

Incel commenting activity on these subreddits also appeared to correspond with the 2018 Toronto van attack. Total daily comments on r/Braincels peaks at 11,916 comments on April 24th 2018, just one day following the attack. As discussed above, this attack was carried out by a self-identified Incel who posted an Incel rallying cry to social media before driving a van into a crowded sidewalk. We are unsure of the extent to which media attention contribution to the peak in comments, as opposed to existing users becoming more active on this day. However, Although we do not make conclusions on the type of activity that caused this peak, we can remark on the cultural significance of the attack and its corresponding peak in activity, prompting further questions about the type of dialogue that was shared on,

before, and after the day of the attack.

The number of unique authors per day increases in the months after the Toronto van attack, while the number of comments decreases. This may indicate that the highest frequency authors decreased their activity, but more investigation is required to explain the discrepancy between total comments and unique authors during this time period.

The lexicon that Incels are known for in popular culture is present in comments on r/Braincels, quantitatively confirming our hypothesis without using a lexicon to search for those words. We compare the distributions of words from random comments and words from r/Braincels comments using rank-turbulence divergence to illuminate the words that are used more often in r/Braincels comments than in random Reddit comments. The bins labeled on the right axis of the histogram and on the word shift plot in Figure 7 are words with high rank divergence, meaning that the rank of these words in r/Braincels diverges markedly from the rank of these words in the random corpus. Nearly all of these words come straight from the Incel lexicon as it is perceived in popular culture and in unofficial Incel dictionaries, and were identified without the use of pre-existing lexicons. The highest ranking word with the greatest divergence contribution is "women", which indicates that discussion on r/Braincels include the word "women" more than discussions from random Reddit comments. The word "chad" has the third highest divergence contribution, and is in reference to the popular caricature of masculinity shown in Figure 1. The words "normie(s)", "foids", "blackpill", "volcel", "roastie(s)", "femoids", "fakecel", "manlet" and "chadlite" are all made-up words that are known to be associated with the Incel community. Their presence in high divergence-contributing words indicates that these words are used more in r/Braincels comments, confirming the popular association between Incel communities and their lexicon.

To further investigate the use of words unique to Incel subreddits, 15 of the high divergence-contributing words from Figure 7 were selected and the timeseries of the relative frequency of these words on r/Incels, r/Braincels, and r/ShortCels was plotted in Figure 8 on a loga-

rithmic scale with base 10. The log relative frequency of these words is qualitatively stable across the three selected subreddits, suggesting that the specific relative frequency and stability of frequency for each word may be an identifiable feature in other Incel communities. To validate that the shape of these timeseries is unique to Incel communities, quantitative comparison of these timeseries to other word frequency timeseries is required.

In addition to comparing word distributions with rank-turbulence divergence, we compared the distributions of subreddits commented on by 4,631 r/Braincels authors to 4,895 random comments. We find that the subreddits commented on by r/Braincels authors with high rank divergence contain other Incel-related subreddits, as well as subreddits culturally known for their connection to alt-right movements. r/IncelTears, r/Incels, r/IncelsWithoutHate, r/PurplePillDebate, r/ForeverAlone and r/shortcels are subreddits for and/or pertaining to Incels. We qualitatively observed content from each of these subreddits to contextualize their presence in the shift plot, but an analysis of the words used on this subreddit is necessary to consider them Incel-associated. r/BlackPeopleTwitter and r/CringeAnarchy are culturally considered to be associated with the alt-right, which may indicate that r/Braincels authors, and by extension some Incels, have associations with other radical political movements.

This result tells us that some Incels do not exclusively participate in one Incel-associated subreddit. Additionally, some Incels show more activity in other extremist-humor subreddits, which suggests that there is a relationship between Incels and other radical movements. To better understand the other subreddits that Incels participate in, the comment history of a larger and more diverse sample of Incel-associated users should be studied. Moving forward, we would like to construct a network of subreddits as nodes, connected by edges that are weighted by the number of users that have commented on both of those nodes. This method can allow us to look at the subreddit ecosystem that Incels exist on, and can inform us on how information is spread through the Incel community and outward onto the rest of Reddit.

Our key findings are that the three Incel subreddits we chose to study show a visual

pattern of being banned and replacing each other, that words from the Incel lexicon can be identified from comments using rank divergence as a measure of importance, and that many of these words appear in a stable and consistent way across all three of our chosen subreddits. The replacement of r/Incels by r/Braincels, and r/Braincels by r/ShortCels, prompts further questions into how Incels might migrate from subreddit to subreddit when one is banned, and how effective banning is overall. The methods of re-organization in this decentralized social group are unknown to us, and further research into how individuals regroup online after banning can give us insights into the efficacy of online censorship. Furthermore, the presence of an Incel community may be identifiable by the stable and consistent presence of words from the Incel lexicon, as shown in our three chosen subreddits. Without bias introduced by a pre-constructed lexicon, we were able to identify words that have high rank divergence when comparing their rank in r/Braincels to their rank in a random comment corpus, showing that words from the lexicon are indeed used more on r/Braincels. The stable timeseries of some of those words shows that their rank wasn't high due to a particular high frequency day, rather the words were highly ranked because of their consistent use. Our exploration of the Incel community has shown that the community appears to recuperate after banning and that the unique words from the Incel lexicon have become part of the steady language on our chosen subreddits.

5 Conclusion

The subreddits we studied show increases in activity that correspond with the banning of subreddits that are central to the Incel community, which prompts questions about author migration away banned subreddits as well as the use of throwaway accounts to further anonymize users. Having reached a peak of comment authorship on the day of the Toronto van attack, the Incel community has the attention of Reddit users, Reddit's content moder-

aters, the US Military and the media. The growing threat of words from the Incel community that incite violence and hatred can be better understood by observing the level of activity in the community, and the ways in which Incels communicate.

The words that are central to communication on Incel-associated subreddits such as r/Braincels can be illuminated by computing their rank divergence given their rank in r/Braincels and their rank in a random set of comments. These words, like "normie", "virgin" and "blackpill", appear consistently over time in r/Braincels and indicate that the Incel lexicon is more than a meme. It is a set of words that signals support for and identification with the Incel community.

Their presence on other parts of Reddit is most markedly seen in other Incel-associated subreddits and in subreddits for alt-right humor. A number of Incels do not participate in just one Incel-associated subreddit, suggesting that there is a network of Incel-related and non-Incel-related subreddits that share a user base. By studying the activities of Incels on Reddit as a whole, rather than in isolated subreddits, we can learn about the various parts and mechanisms of the spread of Incel-related information.

6 Acknowledgements

Thank you to the Vermont Complex Systems Center, the Computational Story Lab, and the University of Vermont Honors College for support in this research. Additionally, many thanks to Chris Danforth and Peter Dodds for their contributions and advising, as well as David Dewhurst and Joshua Minot for additional mentorship and guidance.

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